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EXAMINER

GARCIA OTERO, EDUARDO

| ART UNIT | PAPER NUMBER |
|----------|--------------|
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2123

DATE MAILED: 08/27/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/427,238

Applicant(s)

KAPUR ET AL.

Examiner

Eduardo Garcia-Otero

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 26 October 1999 and 27 March 2000.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-21 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-21 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☒ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 5.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

DETAILED ACTION-NonFinal

Introduction

1. Title is: SYSTEM AND METHOD FOR DETERMINING CAPACITANCE FOR
LARGE-SCALE INTEGRATED CIRCUITS
2. Applicant is: KAPUR et al.
3. Filed 10/26/99, no priority claimed.
4. Claims 1-21 have been submitted, examined, and rejected.

Index

5. **Belk** refers to Belk, US Patent 6,397,171 filed Apr. 1, 1999.
6. **Nabors** refers to PRECONDITIONED, ADAPTIVE, MULTIPOLE-ACCELERATED
ITERATION METHODS FOR THREE-DIMENSIONAL FIRST-KIND INTEGRAL
EQUATIONS OF POTENTIAL THEORY”, K. Nabors et al, Siam Journal on Scientific
Computing, Vol. 15, No. 3, pp. 713-735, May 1994.
7. **Edgecombe** refers to Edgecombe et al., US Patent 6,345,235 filed
8. **Dufour** refers to Dufour, US Patent 6,351,572.

Information Disclosure Statement-missing document

9. **The information disclosure statement is not clear.** The second item states
“INTRODUCTION TO NUMERICAL ANALYSIS,” by J. Soer and R. Bulirsh, Springer
Verlag 1979 and in “PRECONDITIONED...by K. Nabors,...”.
10. This second item appears to refer to 2 publications. Only “PRECONDITIONED...by K.
Nabors” is present in the file. The Examiner has drawn a line through the first publication

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(“INTRODUCTION TO NUMERICAL ANALYSIS,” by J. Soer and R. Bulirsh, Springer Verlag 1979) in order to demonstrate that it has not been considered.

Information Disclosure Statement—request for document

11. The Examiner requests the document that was mentioned in the IDS, but was not submitted: INTRODUCTION TO NUMERICAL ANALYSIS,” by J. Soer and R. Bulirsh, Springer Verlag 1979.

Drawings-additional drawing required

12. “The applicant shall furnish a drawing where necessary for the understanding of the subject matter to be patented” 35 USC 113. Applicant is required to furnish a drawing under 37 CFR 1.81. No new matter may be introduced in the required drawing.
13. Specifically, the Examiner requires a flow-chart drawing showing the detailed steps discussed from Page 11 line 13 to Page 12 line 22. It is not clear whether there is a single iterative loop, or whether there is an outer loop and a nested loop. Note that FIG 2 is not helpful in this respect.
14. Said flow-chart must show when each variable is being solved, and state which equation is being used to solve each variable. The Examiner suggests numbering these equations, and referring to the equations by number, starting with equation (1).

Specification-improper incorporation

15. **The incorporation of essential material in the specification by reference to a foreign application or patent, or to a publication is improper.** Applicant is required to amend the disclosure to include the material incorporated by reference. The amendment must be accompanied by an affidavit or declaration executed by the applicant, or a practitioner

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representing the applicant, stating that the amendatory material consists of the same material incorporated by reference in the referencing application. See *In re Hawkins*, 486 F.2d 569, 179 USPQ 157 (CCPA 1973); *In re Hawkins*, 486 F.2d 579, 179 USPQ 163 (CCPA 1973); and *In re Hawkins*, 486 F.2d 577, 179 USPQ 167 (CCPA 1973). Also see MPEP 608.01(p). Specifically:

16. Page 10 line 15, GMRES: A Generalized Minimal Residual Algorithm for Solving Nonsymmetric Linear Systems.
17. Page 16 line 15, GMRES: A Generalized Minimal Residual Algorithm for Solving Nonsymmetric Linear Systems.
18. Page 20 line 4, Introduction to Numerical Analysis.
19. Page 20 line 65, Preconditioned, Adaptive, Multipole-Accelerated Iterative Methods for Three-Dimensional First-Kind Integral Equations of Potential Theory.

Specification-objections

20. **The Specification is objected to.** Appropriate correction is required.
21. At Page 10 lines 4-9 states “FIGURE 1...the net C3 is captured with relatively **coarse geometric descriptions.**” However, it appears to Examiner that FIG 1 shows C3 with the same level of detail as C1 and C2.
22. “**M**” in the equation at Page 16 line 6 is not defined until Page 18 line 20. The Examiner suggests also defining “**M**” at Page 16, where this variable is first introduced.
23. Page 17 line 4 states “**pertinent are**”, apparently should read “pertinent art”.
24. Page 17 line 22 states “**o is the constant function 1**”. This is unclear. Please clarify.
25. Page 17 line 22 states “**is over**”, apparently should read simply “over”.

26. Page 20 line 4 refers to “INTRODUCTION TO NUMERICAL ANALYSIS,” by J.

Soer and R. Bulirsh, Springer Verlag 1979. See IDS section above, this publication was not submitted.

Claim Rejections-35 USC § 112-first paragraph (Enablement), second (Indefinite)

27. The following is a quotation of the first paragraph of 35 U.S.C. 112: The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

28. The following is a quotation of the second paragraph of 35 U.S.C. 112: The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

29. **Claims 1-21 are rejected under 35 U.S.C. 112, first paragraph, as not enabled, as**

containing subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly

connected, to make and/or use the invention, and **are further rejected under 35**

U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.”

30. Specifically, “integral equation formulation” is not enabled or adequately defined in the Specification. The Specification attempts to enable and define through improper incorporations. For example, Page 16 line 12 states “Krylov method based on a variation of a Generalized Minimal Residual Method (GMRES) for the iterative linear solution. Background information concerning GMRES is discussed in GMRES: A Genralized Minimal Residual Algorithm... (incorporated herein by reference).”

31. Similarly, at Page 29 line 3 “numerical analysis and capacitance calculations is discussed in Introduction to Numerical Analysis...(both incorporated herein by reference).”

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32. Note that “integral equation formulation” is a limitation in all the independent claims (Claims 1, 8, and 15), and all dependent claims are similarly rejection.

33. Thus, Claims 1-21 are rejected as not enabled and as indefinite.

Claim Rejections - 35 USC § 102(e)

34. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

35. A person shall be entitled to a patent unless –

36. (e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

37. The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) do not apply to the examination of this application as the application being examined was not (1) filed on or after November 29, 2000, or (2) voluntarily published under 35 U.S.C. 122(b). Therefore, this application is examined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

38. Claims 1, and 8 are rejected under 35 U.S.C. 102(e).

39. Claim 1 is rejected under 35 U.S.C. 102(e) as being anticipated by Belk.

40. Claim 1 is an independent claim with 2 limitations

41. a charge variation function generator that creates a multidimensional charge variation function that is independent of a conductive geometry of said structure is disclosed by Belk “charge distributions” at Column 12 line 33.

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42. **a conductive geometry generator... that creates a conductive geometry that is independent of charge in said structure** is disclosed by Belk “metalization structures” at Column 2 line 48.

43. **Claim 8 is rejected** under 35 U.S.C. 102(e).

44. Claim 8 is an independent “method” claim with the same limitations as “system” Claim 1, and therefore is rejected for the same reasons.

Claim Rejections - 35 USC § 103

45. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

- (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

46. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

47. **Claims 2-7, 9-21 are rejected under 35 U.S.C. 103(a) as being unpatentable.**

48. **Claim 2 is rejected** under 35 U.S.C. 103(a) as being unpatentable over Belk in view of Stalzer.

49. Claim 2 depends from Claim 1, with one additional limitation.

50. Belk does not expressly disclose the additional limitation:

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51. **Fast Distributed Method (FDM)** is disclosed by Stalzer at Column 1 line 15 Fast Multipole Method and at Column 2 line 13 “cube”.

52. **At the time** the invention was made, it would have been obvious to a person of ordinary skill in the art to use Stalzer to modify Belk. One of ordinary skill in the art would have been motivated to do this because “two dimensional or quasi two dimensional processes...yield very inaccurate results” according to Belk Column 1 lines 38-41.

53. **Claim 3 is rejected** under 35 U.S.C. 103(a) as being unpatentable over Belk in view of Nabors.

54. Claim 3 depends from Claim 1, with one additional limitation.

55. Belk does not expressly disclose the additional limitation:

56. **charge variation function is a three-dimensional function** is disclosed by Nabors at Abstract “three-dimensional, first-kind, integral equations that arise in potential theory”. **At the time** the invention was made, it would have been obvious to a person of ordinary skill in the art to use Nabors to modify Belk. One of ordinary skill in the art would have been motivated to do this because “two dimensional or quasi two dimensional processes...yield very inaccurate results” according to Belk Column 1 lines 38-41. Furthermore, all real charge distributions are three dimensional.

57. **Claim 4 is rejected** under 35 U.S.C. 103(a) as being unpatentable over Belk in view of Edgecombe.

58. Claim 4 depends from Claim 1, with one additional limitation.

59. Belk does not expressly disclose the additional limitation:

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60. **charge variation function is a smooth function of spatial location** is disclosed by Edgecombe at Column 12 line 32 “smooth function”.

61. **At the time** the invention was made, it would have been obvious to a person of ordinary skill in the art to use Edgecombe to modify Belk. One of ordinary skill in the art would have been motivated to do this because “The preferred principal characteristics that we want in our interpolant are robustness and smoothness” according to Edgecombe Column 12 line 36.

62. **Claim 5 is rejected** under 35 U.S.C. 103(a) as being unpatentable over Belk in view of Nabors.

63. Claim 5 depends from Claim 1, with one additional limitation.

64. Belk does not expressly disclose the additional limitation:

65. **conductive geometry generator iteratively creates said conductive geometry** is disclosed by Nabors at Abstract “iterative”.

66. **At the time** the invention was made, it would have been obvious to a person of ordinary skill in the art to use Nabors to modify Belk. One of ordinary skill in the art would have been motivated to do this “because the accelerated method is substantially faster than standard algorithms” according to Nabors Abstract.

67. **Claim 6 is rejected** under 35 U.S.C. 103(a) as being unpatentable over Belk in view of Nabors.

68. Claim 6 depends from Claim 1, with one additional limitation.

69. Belk does not expressly disclose the additional limitation:

70. **said charge variation function generator employs a generalized minimal residual-based Krylov method to determine said multidimensional charge variation function** is disclosed by Nabors at Abstract “Krylov-subspace iterative algorithm”.
71. **At the time** the invention was made, it would have been obvious to a person of ordinary skill in the art to use Nabors to modify Belk. One of ordinary skill in the art would have been motivated to do this “because the accelerated method is substantially faster than standard algorithms” according to Nabors Abstract.
72. **Claim 7 is rejected** under 35 U.S.C. 103(a) as being unpatentable over Belk in view of Dufour.
73. Claim 7 depends from Claim 1, with one additional limitation.
74. Belk does not expressly disclose the additional limitation:
75. **said conductive geometry is represented in an octtree** is disclosed by Dufour at Column 2 line 6 “octree subdivision of the 3D space”.
76. **At the time** the invention was made, it would have been obvious to a person of ordinary skill in the art to use Dufour to modify Belk. One of ordinary skill in the art would have been motivated to do this because “octrees are an efficient representation for many volumetric objects since there is a large degree of coherence between adjacent voxels in a typical object” according to Dufour at Column 2 line 14.
77. **Claim 9-14 are rejected** under 35 U.S.C. 103(a).
78. Claims 9-14 are “method” claims with the same limitations as “system” Claims 2-7, and therefore are rejected for the same reasons.

79. **Claim 15 is rejected** under 35 U.S.C. 103(a) as being unpatentable over Belk in view of Nabors.

80. Claim 15 is an independent claim with 3 limitations.

81. **1-a charge variation function generator that creates a multidimensional charge variation function that is independent of a conductive geometry of said integrated circuit** is disclosed by Belk “charge distributions” at Column 12 line 33.

82. **2-a conductive geometry generator that creates a conductive geometry that is independent of charge in said integrated circuit** is disclosed by Belk “metalization structures” at Column 2 line 48.

83. Belk does not expressly disclose the third limitation:

84. **3-an integral equation formulator, associated with said charge variation generator and conductive geometry generator, that determines said capacitance of said integrated circuit** is disclosed by Nabors at Abstract “integral equations”.

85. **At the time** the invention was made, it would have been obvious to a person of ordinary skill in the art to use Nabors to modify Belk. One of ordinary skill in the art would have been motivated to do this “because the accelerated method is substantially faster than standard algorithms” according to Nabors Abstract.

86. **Claim 16 is rejected** under 35 U.S.C. 103(a) as being unpatentable over Belk in view of Nabors and Stalzer.

87. Claim 16 depends from Claim 15, with one additional limitation.

88. Belk does not expressly disclose the additional limitation:

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89. **Fast Distributed Method (FDM)** is disclosed by Stalzer at Column 1 line 15 Fast Multipole Method and at Column 2 line 13 “cube”.

90. **At the time** the invention was made, it would have been obvious to a person of ordinary skill in the art to use Stalzer to modify Belk. One of ordinary skill in the art would have been motivated to do this because “two dimensional or quasi two dimensional processes...yield very inaccurate results” according to Belk Column 1 lines 38-41.

91. **Claim 17 is rejected** under 35 U.S.C. 103(a) as being unpatentable over Belk in view of Nabors.

92. Claim 17 depends from Claim 15, with one additional limitation.

93. Belk does not expressly disclose the additional limitation:

94. **charge variation function is a three-dimensional function** is disclosed by Nabors at Abstract “three-dimensional, first-kind, integral equations that arise in potential theory”. **At the time** the invention was made, it would have been obvious to a person of ordinary skill in the art to use Nabors to modify Belk. One of ordinary skill in the art would have been motivated to do this because “two dimensional or quasi two dimensional processes...yield very inaccurate results” according to Belk Column 1 lines 38-41, and “because the accelerated method is substantially faster than standard algorithms” according to Nabors Abstract.

95. **Claim 18 is rejected** under 35 U.S.C. 103(a) as being unpatentable over Belk in view of Nabors and Edgecombe.

96. Claim 18 depends from Claim 15, with one additional limitation.

97. Belk does not expressly disclose the additional limitation:

98. **charge variation function is a smooth function of spatial location** is disclosed by Edgecombe at Column 12 line 32 “smooth function”.

99. **At the time** the invention was made, it would have been obvious to a person of ordinary skill in the art to use Nabors and Edgecombe to modify Belk. One of ordinary skill in the art would have been motivated to do this because “The preferred principal characteristics that we want in our interpolant are robustness and smoothness” according to Edgecombe Column 12 line 36, and “because the accelerated method is substantially faster than standard algorithms” according to Nabors Abstract.

100. **Claim 19 is rejected** under 35 U.S.C. 103(a) as being unpatentable over Belk in view of Nabors.

101. Claim 19 depends from Claim 19, with one additional limitation.

102. Belk does not expressly disclose the additional limitation:

103. **conductive geometry generator iteratively creates said conductive geometry** is disclosed by Nabors at Abstract “iterative”.

104. **At the time** the invention was made, it would have been obvious to a person of ordinary skill in the art to use Nabors to modify Belk. One of ordinary skill in the art would have been motivated to do this “because the accelerated method is substantially faster than standard algorithms” according to Nabors Abstract.

105. **Claim 20 is rejected** under 35 U.S.C. 103(a) as being unpatentable over Belk in view of Nabors.

106. Claim 20 depends from Claim 15, with one additional limitation.

107. Belk does not expressly disclose the additional limitation:

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108. **said charge variation function generator employs a generalized minimal residual-based Krylov method to determine said multidimensional charge variation function** is disclosed by Nabors at Abstract “Krylov-subspace iterative algorithm”.

109. **At the time** the invention was made, it would have been obvious to a person of ordinary skill in the art to use Nabors to modify Belk. One of ordinary skill in the art would have been motivated to do this “because the accelerated method is substantially faster than standard algorithms” according to Nabors Abstract.

110. **Claim 21 is rejected** under 35 U.S.C. 103(a) as being unpatentable over Belk in view of Dufour and Nabor.

111. Claim 21 depends from Claim 15, with one additional limitation.

112. Belk does not expressly disclose the additional limitation:

113. **said conductive geometry is represented in an octtree** is disclosed by Dufour at Column 2 line 6 “octree subdivision of the 3D space”.

114. **At the time** the invention was made, it would have been obvious to a person of ordinary skill in the art to use Dufour and Nabor to modify Belk. One of ordinary skill in the art would have been motivated to do this because “octrees are an efficient representation for many volumetric objects since there is a large degree of coherence between adjacent voxels in a typical object” according to Dufour at Column 2 line 14.

Patentable material

115. At present, the Examiner believes that this application may contain some potentially patentable material. Specifically, Claims 2, 9, and 16 have not been rejected against prior art, though they have been rejected on other grounds.

Additional Cited Prior Art

116. The following US patents or publications are hereby cited as prior art, but have not been used for rejection. Applicant should review these carefully before responding to this office action.
117. **Kapur** et al., US Patent 6,051,027 filed July 16, 1998, discloses “decouple the computation of the far field from the layer structure and circuit geometry, minimizing computation time” at Abstract.
118. **Kapur** et al., US Patent 6,314,545 filed Nov. 6, 1998, discloses “each region is further divided into a plurality of quadrature nodes”.
119. **Turkiyyah** et al., US Patent 6,133,921, filed May 23, 1997, discloses “discretizing the space...using quadtrees, octrees, etc.,” at Column 1 lines 58-60.

Conclusion

120. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Eduardo Garcia-Otero whose telephone number is 703-305-0857. The examiner can normally be reached on Monday through Thursday from 9:00 AM to 7:00 PM.

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121. If attempts to reach the Examiner by telephone are unsuccessful, the Examiner's supervisor, Kevin Teska, can be reached at (703) 305-9704. The fax phone numbers for this group are:
122. (703) 746-7238 --- for communications after a Final Rejection has been made;
123. (703) 746-7239 --- for other official communications; and
124. (703) 746-7240 --- for non-official or draft communications.
125. Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the group receptionist, whose telephone number is (703) 305-3900.

* * * *


DR. HUGH M. JONES
PATENT EXAMINER
ART UNIT 2123